



A Diner's Guide to Evaluating A Framework for Ubiquitous Computing Applications

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Ubicomp evaluations are difficult to evaluate because:

- Augment a current experience
- Are not necessarily single user
- Are used in a social environment rather than in a single user work environment
- May involve a number of separated displays
- Are not just about being effective or efficient
- Come in a wide variety of shapes and sizes
- Often depend on context to shape interactions



What is so difficult about evaluation of Ubicomp applications?

- Traditional evaluation methodologies are limited
- We do not currently have agreed upon metrics appropriate for evaluating the user experience
- It is difficult to learn from each other's experience as we do not have a standard vocabulary



What's an approach?

- Develop a framework for evaluation that researchers can use to share lessons learned
- A framework for evaluation would:
 - Make it easier to learn from each other
 - Enable creation of guidelines and "discount" methods of evaluation
 - Provide a way to share evaluation methodologies
 - Provide structure for planning evaluations

The Framework: Ubicomp Evaluation Areas (UEAs)

- Contain:
 - Definition
 - Metric: meaning associated with a measure
 - Conceptual measure: an observable value
- Metrics are used to compare two systems based on measures.
- Conceptual versus implementation measures
 - The actual measurement may differ depending on the application under consideration
- UEAs do overlap



Framework Emphasizes Stakeholders Rather than Users

- Traditional usability evaluations focus on users
- In ubiomp applications we want to emphasize stakeholders
 - Direct stakeholder is the person interacting with the application
 - Indirect stakeholder - people engaged in activities with the direct stakeholders while the interaction is occurring



The Framework Identifies 9 Ubicomp Evaluation Areas

- Attention
- Adoption
- Trust
- Conceptual Models
- Interaction
- Invisibility
- Impact and Side Effects
- Appeal
- Application Robustness



Expanding one UEA: Impact and Side Effects

Metrics

- Utility -- Changes in productivity
- Behavior changes - type, frequency, and duration; willingness to change behavior to use the application
- Social acceptance - requirements place on user outside of social norms; aesthetic ratings
- Environment change -- type, frequency, and duration; willingness to change environment to use



Case Study: A Handheld Ordering System in Restaurants

- Wireless handheld order entry system
- Relies on handwriting recognition
- Mimics little green pad
- Developed by Action Systems Inc.



Any commercial product identified in this document is for the purpose of describing a ubicomp application to evaluate the framework and does not imply any recommendation or endorsement by NIST.

What did we find?

Stakeholders

- Direct - servers (wait staff)
- Indirect - customers, kitchen and bar staff, manager and restaurant owner.





How did the UEAs measure up?

Impact and Side Effects

- Utility
 - measurable improvements in productivity, performance and quality
- Behavior changes
 - Wait staff needs uniforms that accommodate device;
 - Wait staff more technically oriented than previously
 - Orders come up faster so runners are used to deliver drinks and meals
 - Fewer waiters are needed
- Social acceptance
 - Device must fit into up scale restaurant
 - Do customers mind if staff is using device?



How did the UEA's measure up?

Attention

- How many times do wait staff have to change focus - from device to customer?
- Does Attention to device take away from social interaction with customers?



How did the UEA's measure up?

Interaction

- Distraction - the primary task is to focus on and serve the customer not the technology
- Scalability - How many waiters can be supported at once?
- Efficiency, effectiveness, and user satisfaction were addressed through iterative development

How did the UEA's measure up?

Adoption

- Cost of training and setup
- Flexibility and value - status quo and inertia for paradigm shift

Conceptual Model

- Different model than drill down menu and touch pad systems

Application Robustness

- What is the wireless coverage?
- Hardware concerns - including battery life and effective backlighting

What's Next?

- Encourage researchers to use framework
 - Determine what is missing and what should be eliminated
 - What are the interactions between the UEAs?
 - Which UEAs are most appropriate for which type of ubicomp applications?
- Populate framework with results
 - Determine if this is helpful to other researchers
 - Can framework predict which systems will be useful and accepted by users?
 - Do guidelines emerge from consolidating lessons learned?



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